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Abstract

This chapter reports on a preliminary study examining the production of grammatical evidentiality forms in narrative speech samples elicited from heritage language speakers (HLS) of Turkish. Turkish grammatically marks direct and indirect sources of evidence one has for his statement. We explored (i) how Turkish HLS use evidentiality marking as compared to monolingual Turkish speakers, and (ii) which factors predict their performances in producing evidentiality. Our findings showed that the HLS made a large number of contextually inappropriate substitutions by using direct evidentials in places where an indirect evidential would be used, and that this pattern is largely predicted by the amount of self-reported exposure to the first (heritage) language in daily life.

Keywords: Evidentiality; Narrative speech; Heritage language speakers; Turkish-Dutch bilingualism.

Introduction

This chapter examines the appraisal of grammatical forms for evidentiality, the marking of information sources, in narrative speech production of 'heritage' language speakers (HLS) of Turkish in the Netherlands. HLS are often referred to as early bilingual individuals (either simultaneous or sequential) who have acquired a minority language in family contexts and a majority society language at school (Benmamoun, Montrul, & Polinsky, 2013; Rothman, 2009). Especially those HLS who grow up under immigrant language conditions gradually loose competence in their first language[1] vocabulary and grammar, as their society language becomes more dominant in time. This pattern of language development is common among Turkish HLS in the Netherlands who often face unstable bilingualism conditions where the majority society language (i.e. Dutch) grows dominantly in use over their Turkish (e.g., Backus, 2004, 2013; Doğruöz & Backus, 2009; Sevinç, 2016). Turkish HLS are second generation immigrants, and some of these HLS may, in fact, reach a monolingual-like sensitivity in their first language use while some others begin to deviate from this sensitivity, unlike their monolingual peers. Variability in HLS's linguistic outcomes has been shown to be influenced by a number of societal factors (see e.g., Backus, 2013; Bezcioglu-Goktolga & Yagmur, 2018; Extra & Yağmur, 2010). This chapter, however, particularly examines aspects of subtractive bilingualism in Turkish HLS with a focus on factors relating to the first language input, building upon studies that showed non-target-like attainment in certain grammatical structures of the first language in HLS may be incompletely acquired (e.g. Montrul, 2008) or attrited after full acquisition (Polinsky, 2011).

[1] Please note that in this chapter the term first language is used synonymously with heritage language or home/family language (i.e. Turkish), in other bilingualism settings, however, first language may not necessarily be the heritage language.

Recent studies, using narrative speech tasks, have indicated that inflectional morphology and referring expressions are particularly susceptible in HLS's first language performance. For instance, (Montrul, 2002, 2009), using both elicited narrative speech and grammaticality judgement tasks, showed that Spanish adult HLS are less sensitive to aspectual (Preterit–Imperfect) and modal (Subjunctive–Indicative) distinctions than monolingual Spanish speakers. Albirini, Benmamoun, and Chakrani (2013) showed that adult Arabic HLS's production performances of gender and number agreement in narratives fall behind Arabic monolingual adults. Polinsky (2006, 2008) reported that Russian adult HLS's uses of case, tense–aspect, and agreement morphology differ from the monolingual baseline and that HLS tend to use shorter utterances which contain reduced syntactic complexity and restricted diversity of lexical choices. Jia and Paradis (2015) found that Mandarin heritage speaking children use a reduced number of referring expressions, such as indefinite determiners and possessive constructions, as compared to monolingually developing children.

There are three different explanations for why adult HLS's language outcomes differ from monolingual speakers. First, the incomplete acquisition account holds that heritage language grammar acquisition is disrupted in early bilingual HLS, and consequently, at adulthood, the heritage language grammar has gaps in knowledge in comparison to monolingual language development, possibly due to reduced input conditions (see Montrul, 2008; 2015 for discussion). According to a second view, however, any gaps or insensitivity in the final state of HLS's grammatical knowledge of their heritage language are results of attrition. That is, certain structures in heritage grammars are fully acquired in childhood and then attrited later in life. Although attrition is often observed in late bilingualism settings, such as in proficient second language learners (see Köpke, Schmid, Keijzer, & Dostert, 2007; Schmid, 2013), there has been evidence that HLS may also be affected by attrition (Polinsky, 2008, 2011). A third account, by contrast, suggests that HLS's differences in the end state of

their first language grammar are affiliated with the nature of input HLS receive during their language development (Kupisch & Rothman, 2016; Pascual y Cabo & Rothman, 2012; Putnam & Sánchez, 2013). Specifically, Pascual y Cabo and Rothman (2012) argued that the input in heritage language acquisition may have been affected by attrition across generations, suggesting that HLS's non-target-like attainment may be linked to exposure to a form of input which contains attrited or simplified grammar structures during heritage language acquisition. See also, Kupisch and Rothman (2016) who note that the lack of formal education in heritage language is an important factor that reduces HLS's access to rich input. Putnam and Sánchez's (2013:488) model accounts that diminishing frequency of exposure to heritage language along the developmental stages leads to a low level of activation for certain functional structures, and consequently, lower activation in heritage language grammar results in "gradual replacement by functional values" in the dominant society language. However, HLS's performances in their first (heritage) language have been shown to be subject to large individual differences (see e.g., Montrul & Sánchez-Walker, 2013; Pascual y Cabo & Rothman, 2012). It is however not well understood what determines this variability.

This study reports on data from narrative speech tasks administered to Turkish heritage speakers in the Netherlands. We investigated the appraisal of inflectional forms for evidentiality in narrative speech production of our Turkish HLS using a machine learning algorithm to determine which input-related factors (e.g. amount of exposure, proficiency, etc.) best predict Turkish HLS's potential non-target-like uses of evidentiality.

Some features of evidentiality in Turkish

Evidentiality encodes sources of information (e.g. witnessing, inferring, hearing from another speaker) through which the speaker obtains the knowledge about an event represented in his statement (Aikhenvald, 2004). In most languages, including Dutch, the evidential status of

statements can optionally be marked using adverbs (e.g. *apparently*) or reporting and modal verbs. In a number of languages, however, evidentiality constitutes a grammatical category encoded through verbal forms uses of which are often obligatorily. Turkish is an 'evidential language' and it grammatically marks 'information sources' through inflection morphemes affixed to the verb. Referring to the past requires Turkish speakers to make a choice between direct and indirect evidential forms. The direct evidential (-DI) conveys that the speaker has directly witnessed an event, see (1). The indirect evidential (-mIş), by contrast, reflects that the speaker has access to an event through second-hand knowledge, such as inference or verbal report from another speaker, as given in (2), (e.g. Johanson, 2000; Slobin & Aksu, 1982).

(1) Kadın bulaşığı yıka**dı.**

Woman dishes.ACC wash.DIRECT EVID.

'The woman washed the dishes' [witnessed]

(2) Kadın bulaşığı yıka**mış.**

Woman dishes.ACC wash.IDIRECT EVID.

'The woman washed the dishes.' [inferred or reported knowledge]

In (1), the use of a direct evidential form signals that the speaker witnessed the woman as she was washing the dishes. In (2), however, the use of an indirect evidential form encodes that the speaker did not witness the event directly, but inferred that woman washed the dishes or heard about it from another speaker.

Importantly, evidential forms act as narrative conventions: while the direct evidential is an appropriate form to talk about one's personal or experienced stories, the indirect evidential is

the traditional way of recounting folktales or reporting stories heard from others (Aksu-Koç, 1988).

Relevant studies on Turkish heritage speakers

Turkish spoken as a heritage language in European countries has long been studied with regard to narrative production using different analysis techniques. For instance, Pfaff (1991, 1993) elicited free-speech production while others used story-telling tasks (e.g. Aarssen, 2001; Maviş, Tunçer, & Gagarina, 2016; Schaufeli, 1993). Findings from those studies showed that Turkish HLS's narratives differ from those of their monolingual Turkish peers as they tend to lack complex syntactic structures (e.g. embedded clauses), lexical resources seem to be limited, and uses of inflectional morphology are occasionally inconsistent (Daller, Van Hout, & Treffers-Daller, 2003; Gürel & Yilmaz, 2011; Maviş et al., 2016; Pfaff, 1991; Schaufeli, 1993; Treffers-Daller, Özsoy, & Van Hout, 2007; Valk & Backus, 2013).

Evidential forms have been shown to be affected in Turkish HLS. For example, Pfaff (1993) reported that a Turkish child HLS who was rather more dominant in German produced fewer indirect evidentials than other bilingual children with Turkish-dominant language use. Instead, the child described events by using direct evidential or present progressive forms. Furthermore, Aarssen (2001) showed that Turkish child HLS in the Netherlands make inappropriate shifts between the evidential forms, even at the age of 10 while monolingual Turkish children have better command over the evidential morphology much earlier (Aksu-Koç, 1988). Karakoç (2007) also reports similar findings from inappropriate shifts between evidentials and indeterminant uses of these inflectional forms in child HLS of Turkish growing up in Germany. Karayayla (To appear) studied adult Turkish HLS in the UK using semi-structured interviews and picture description tasks. Her data showed that Turkish HLS produced a larger number of inappropriate uses of indirect evidential forms, mostly because

indirect evidential forms were substituted by direct ones, as compared to Turkish monolingual speakers.

Furthermore, Arslan, Bastiaanse, and Felser (2015) tested Turkish HLS's processing of sentences marked either with a direct or an indirect evidential by monitoring participants' eye-movements in a visual world paradigm. Their data showed that Turkish HLS turned their gaze onto the target pictures less often than monolinguals did and that HLS's eye-movements tended to fluctuate between the target and non-target pictures during the processing of the direct evidential form. Turkish monolinguals showed an interesting pattern of eye-movements during their processing of direct evidential, they fixated towards the picture that depicts the action in-progress before their gazes turned to the target picture. This pattern was lacking in Turkish HLS's eye-movements, suggesting that these HLS had less of a need to look for a shred of evidence for the direct evidential condition. Arslan, de Kok, and Bastiaanse (2017) using a sentence verification task, examined a group of adult Turkish HLS living in the Netherlands. The authors used sentences that contained violations in evidential contents (e.g. *Yerken gördüm, az önce adam yemeği yemiş*, 'I saw the man while he is eating; he ate the food') to which participants were asked to respond if they detect any form of unacceptability. Their data showed that the monolingual Turkish speakers were faster and more accurate in responding to the task overall than HLS. Nonetheless, Turkish HLS largely failed detecting evidentiality mismatches by both direct and indirect evidential forms (with about 32% accuracy).

In summary, the previous studies have shown that Turkish HLS's command in evidential forms is either delayed or does not reach a complete non-target-like sensitivity. However, the so-far-mentioned studies are inconclusive in explaining why and which factors contribute to non-target-like attainment of evidential morphology in Turkish HLS. This is the

topic to be explored in the current study. In particular, we formulated the following research questions:

1) Does the production of direct and indirect evidential forms in Turkish HLS differ from the monolingual baseline?

2) If so, which input related factors (e.g., daily language use, amount of exposure) predict non-target-like uses of evidentiality in HLS?

Regarding our first question, provided the results from earlier studies, uses of evidential forms in Turkish HLS under investigation here are expected to differ from those in a reference group of Turkish monolingual speakers. Concerning our second question, the three theoretical approaches to adult HLS language outcomes in their heritage language predict different scenarios as to which factors might influence HLS's non-target-like uses of evidentiality. First, the incomplete acquisition account predicts that Turkish HLS's non-target-like uses of evidentiality would be caused by disrupted acquisition processes due to reduced input, and consequently, HLS's knowledge of evidentiality would be incomplete. Second, under the attrition perspective, Turkish HLS's knowledge of evidentiality is expected to differ from the monolingual baseline as a result of gradual regression. Finally, another cluster of studies would predict that Turkish HLS's non-target-like attainment of evidentiality might be affiliated with the lack of rich quality input (e.g. Pascual y Cabo & Rothman, 2012) and with a low frequency of exposure to the heritage language (Putnam & Sánchez, 2013).

Method

Participants

Ten Turkish HLS living in Amsterdam, the Netherlands, were tested. Prior to testing, the participants completed a detailed demographic and bilingualism background questionnaire

(see Table 1). The HLS had their first contact with Turkish in family settings and they began learning Dutch from about 3 years of age. In addition, 10 monolingual Turkish speakers (6 females, age = 24.2, ranges = 17–29) were tested in Turkey as a reference group. The monolinguals neither spoke any second language proficiently nor had they spent an extensive period of stay in a foreign country.

Table 1. Demographic and bilingualism background data from the Turkish HLS (Self-rated proficiency columns indicate averages language skills, maximum score = 5; Daily language exposure demonstrates the HLS's estimation of the number of hours they spent being exposed to a language receptively (i.e. listening and reading)).

Part.	Gender	Age	Self-rated proficiency		Daily language use (%)		Daily language* exposure (hours)		Bilingual parents? **
			Turkish	Dutch	Turkish	Dutch	Turkish	Dutch	
H1	M	18	2.50	4.25	50	50	4	7	Yes
H2	M	18	3.75	5.00	25	75	1	7	Yes
H3	M	18	4.00	4.75	50	50	3	4	Yes
H4	M	16	3.75	5.00	50	50	2	3	No
H5	M	17	4.50	5.00	50	50	3	3	No
H6	F	18	4.50	5.00	50	50	4	4	No
H7	F	18	4.25	5.00	50	50	4	5	Yes
H8	F	18	4.50	5.00	25	75	1	5	Yes
H9	F	17	3.25	5.00	25	75	3	6	Yes
H10	F	17	3.75	5.00	50	50	1	1	Yes
Mean (SD)		17.50 (0.70)	3.87 (0.63)	4.90 (0.24)	42.50 (12.07)	57.50 (12.07)	2.60 (1.26)	4.50 (1.90)	

* Note that all of the HLS reported here spoke English as a foreign language fluently.

** "No" in *bilingual parents* means at least one of the parents can only speak Turkish. However, note that parental interaction for all the participants was reported to occur in Turkish only.

Materials

The study included three tasks. First, the participants were given a *spontaneous speech* interview with open-end questions; see (I) below. Second, a *picture description* task was conducted in which the participants were asked to create stories. To elicit those stories, questions in (II) were used with the 'flood rescue' photo taken by Annie Wells and the 'cookie theft' photo (Goodglass & Kaplan, 1972). Finally, a *storytelling* task was administered by using the questions in (III). Production of evidentiality is context-sensitive as, for instance, retellings of personal experience require uses of direct evidential while traditional story-telling in Turkish entails the use of indirect evidential form. Therefore, we chose to use different contexts to elicit narratives. Some participants were reluctant to talk in certain tasks, when this was the case, experimenter encouraged participants to talk with complementary questions (e.g. Can you elaborate? Can you tell me the details?) to avoid unbalanced speech samples.

(I) Spontaneous speech interview:

- *Bana biraz kendinden ve hobilerinden bahseder misin?* 'Could you talk about yourself and your hobbies?'
- *Bana geçirdiğin en iyi tatilini anlatabilir misin?* 'Could you tell me about the best holiday you have had?'
- *Dün neler yaptığını anlatabilir misin?* 'Could you talk about what you did yesterday?'

(II) Picture description task:

- *Bu resimde neler gördüğünü anlatabilir misin?* 'Could you tell me what you see in this picture?'

- *Bu resimle ilgili bir başı, ortası ve sonu olan bir hikaye yaratabilir misin?* 'Could you make a story with a beginning, middle and end about this picture?'

(III) Storytelling task:

- *Seyrettiğin bir filmi anlatabilir misin?* 'Could you talk about a movie you have seen?'
- *Duyduğun bir masal veya fıkra anlatabilir misin?* 'Could you tell me a folktale or an anecdote you have heard?'

Procedure

The three tasks were administered in a single session with each participant individually. All participants responded to all questions in the tasks. The sessions were digitally recorded and orthographically transcribed by two Turkish-speaking research assistants. A 600-word sample per participant with an equal proportion of words for each task was extracted. The reason for why we used a fixed number of words stems from the fact that we need to elicit comparable amounts of finite verbs to examine the production of evidentiality. Turkish evidentials are expressed on finite verbs, and Turkish HLS have been shown to differ from their monolingual peers in Turkey in that they tend to over-produce finite verbs with shorter and less complex clauses using a lower number of non-finite verbs in relative or subordinate clauses (see e.g. Valk & Backus, 2013). Thus, we used speech samples with a fixed number of words[2] in which the number of utterances and finite verbs are comparable across groups (see in the results section below) to avoid a scenario where HLS's evidentiality production is confounded due simply to a greater number of finite verbs produced. We made sure that the speech samples contained similar number of utterances across tasks and that all participants' responses to every elicitation question were represented in the speech samples. Only very

[2] Please note that using fixed-number of words does not necessarily compromise sample sizes, it is only relevant to us from a very pure methodological point of view. Furthermore, samples analysed here are in fact not any smaller than many studies that employed the 'whole data' approach, for instance, Aksu-Koç's (1994) norms for adult Turkish narratives contained a mean number of 82 clauses, which are comparable to our samples here (see Table 2 below).

small portions of data were discarded during extraction (about 1-2% per participant, roughly 2-4 clauses). The following variables were independently scored by two independent Turkish linguists:

- Mean length of utterances (MLU = number of words divided by the number of utterances).[3]
- The number and diversity of finite verbs, including non-verbal predicates (measured by type/token ratio (TTR) = different types of finite verb lemmas lexemes divided by the total number of finite verb tokens) and the ratio of finite and non-finite verbs per utterance.[4,5]
- Frequency of verb inflections for evidentiality.
- The number of contextually inappropriate substitution errors (i.e. non-target-like uses). A verb inflection inappropriately used in place of another inflection was counted as a substitution error. Note that inflection shifts that convey clear communicative functions were not counted as a substitution error. For instance, Turkish narrators often alternatively use present progressive forms in reference to personally experienced events to make their narratives sound 'lively' (see Aksu-Koç, 1994; Karakoç, 2007). Hence, such instances of inflection shifts were not counted as errors.

Group differences were tested using independent samples t-tests. Potential predictors of non-standard uses of evidentiality were determined using J48 tree-based classification algorithm (Quinlan, 1993). J48 is a machine learning algorithm used for data classification based on binary decision trees, that is, it generates simple decision trees to decide whether

[3] Although the main topic in this chapter is the appraisal of evidential forms, we have included MLU and diversity of finite verbs in our analyses to be able to provide information on the general characteristics of narratives in which evidential forms are quantified.
[4] TTR is a reliable measure of diversity when sample sizes and tokens are equal (Malvern & Richards, 1997).
[5] We tallied non-verbal predicates (e.g. nominal predicates, existential forms and copulas) under the label of finite verbs as evidential forms can also be appended to those structures.

data points belong to class A or class B. J48 is a very accurate and cost-effective algorithm for binary classification problems (Patil & Sherekar, 2013). It has widely been used in clinical research, for instance, to predict whether one gets diabetes or not (Kaur & Chhabra, 2014). Following a similar analogy, we used J48 algorithm to predict whether HLS use evidentiality correctly or not, and importantly, to unveil which input-relevant factors best determine their non-target-like uses of evidentiality. Furthermore, this classification model is advantageous in comparison to many other statistical procedures used in bilingualism field; to enumerate, mixed-effects regression models, as per example, cannot hold too many factors especially when they correlate with each other. In simple decision-tree-based classification models, such problems are minimal. The following steps were taken in the machine learning analyses:

- *Variable selection and importance*: Before the data were implemented in the J48 algorithm, potential predicting factors were evaluated using the 'information gain' procedure, see (Quinlan, 1986). This procedure determines which factors (i.e. variables) are the most useful in discriminating the target classes (i.e. correct vs. incorrect uses of evidentiality). The following variables were determined to be potentially the most important ones:
    - Self-rated proficiency in Turkish and Dutch (individuals' own estimates for their language skills proficiency in reading, listening, speaking, and writing were first collected on a 5-point scale for each language separately, 1 being low and 5 being high, and the average of these four skills were taken as the overall proficiency in each language).[6] This method to measure Turkish HLS's

[6] Please note that methods to calculate language dominance and proficiency in bilingual individuals include a number of different measures with only minimum agreement among authors (see e.g., Treffers-Daller, 2015). The self-rated proficiency scores only point to a rough estimate of the HLS's language abilities, and therefore, should not be taken as an exact indication of dominance or proficiency.

language proficiencies has widely been employed and been shown to be highly reliable, see Sevinç (2016).

- Estimated percent daily language use of Turkish and Dutch (individuals' estimated language use in percentages during a usual day).
- Daily exposure to Turkish and Dutch (Individuals' estimates of their language exposure by for instance reading and listening in terms of number of hours in a usual day). See Table 1 above for individual data for these variables.

- *Data interpolation*: As the data set we used in our analyses were unbalanced due to larger number of correctly used evidential forms over substitution errors, we interpolated synthetic sample of errors using the Synthetic Minority Oversampling Technique following Chawla, Bowyer, Hall, and Kegelmeyer (2002). That is, additional data points for substitution errors were estimated based on the existing ones to minimalize misclassification errors in machine learning.

- *Implementation and decision tree visualization*: The J48 decision tree algorithm was employed to classify correct and incorrect uses of evidentiality using the WEKA software version 3.6.13 (The University of Waikato, Hamilton, New Zealand). A ten-fold cross-validation was used in the learning implementation. That is, randomly selected 9/10 of the data were used to train the learning algorithm and the remaining 1/10 to test the algorithm. This process was repeated 10 times until all dividends of the data were used in testing. The most accurate decision tree was reported.

Results

General characteristics of utterances and finite verbs

Table 2 presents individual scores for general characteristics of produced utterances and finite verbs in the analyzed samples. The statistical outputs from independent samples t-tests indicated that the HLS did not produce fewer utterances ($t(18) = -1.06$, $p = 0.30$) nor were their utterances shorter, as measured by MLU, ($t(18) = 0.98$, $p = 0.33$) than those of the monolinguals. The HLS produced similar numbers of finite verbs ($t(18) = -1.32$, $p = 0.48$) as the monolinguals. However, the diversity of those finite verbs in the HLS, as measured by TTR, was significantly reduced ($t(18) = 3.85$, $p = 0.001$). The HLS's ratio of finite verbs per utterance was not different from the monolinguals ($t(18) = -0.13$, $p = 0.89$); nonetheless, they produced fewer non-finite verbs than monolinguals ($t(18) = 2.85$, $p = 0.011$).[7]

Inflected forms for evidentiality

In Table 3, the number of verb inflections for evidentiality and present progressive are demonstrated. We also provide the number of present progressive forms here as this form was largely produced by both the groups. Outputs from a set of independent samples t-tests demonstrated that the number of direct evidential morphemes produced by the HLS in 600-word samples was similar to that of the monolingual speakers ($t(18) = -0.28$, $p = 0.78$), as was the number of indirect evidential morpheme ($t(18) = 0.53$, $p = 0.59$). The only significant group difference indicated an overuse of present progressive form in the HLS as compared to the monolinguals ($t(18) = -2.26$, $p = 0.036$). The HLS produced fewer indirect evidential than direct evidential forms in their narratives ($t(18) = 2.64$, $p = 0.027$), yet this difference was not significant in the monolinguals ($t(18) = 1.73$, $p = 0.11$).

[7] Notice that non-finite verbs are mainly used in subject and object relative clauses.

Table 2. Individual scores of general characteristics of utterances and (non)-finite verbs (heritage speakers (H1-10) and monolingual speakers (M1-10)).

	Nr Utterances	MLU	Finite verbs	TTR finite verbs	Finite verb per utterance	Non-finite verbs
H1	126	4.76	125	0.62	0.99	25
H2	126	4.76	134	0.63	1.06	30
H3	200	3.00	117	0.63	0.59	38
H4	98	6.12	99	0.70	1.01	28
H5	110	5.45	109	0.61	0.99	44
H6	123	4.88	135	0.58	1.10	28
H7	108	5.56	115	0.68	1.06	24
H8	144	4.17	135	0.63	0.94	20
H9	102	5.88	109	0.70	1.07	39
H10	129	4.65	139	0.56	1.08	27
Mean (SD)	126.6 (29.3)	4.9 (0.90)	121.7 (13.8)	0.63 (0.04)	0.98 (0.11)	30.3 (7.5)
M1	126	4.76	123	0.57	0.98	49
M2	97	6.19	104	0.86	1.07	54
M3	118	5.08	99	0.70	0.84	33
M4	83	7.23	88	0.72	1.06	45
M5	120	5.00	114	0.72	0.95	38
M6	116	5.17	93	0.76	0.80	39
M7	107	5.61	119	0.76	1.11	48
M8	122	4.92	111	0.82	0.91	29
M9	123	4.88	140	0.89	1.14	45
M10	141	4.26	134	0.90	0.95	28
Mean (SD)	115.3 (16.1)	5.3 (0.84)	112.5 (17.0)	0.77 (0.10)	0.98 (0.15)	40.8 (8.8)

Table 3. The number of finite verb inflections (in raw counts) for direct, indirect evidential and present progressive forms (heritage speakers (H1-10) and monolingual speakers (M1-10)).

	Direct evidential	Indirect evidential	Present progressive
H1	20.0	14.0	54.0
H2	44.0	15.0	34.0
H3	17.0	2.0	85.0
H4	45.0	0.0	37.0
H5	28.0	8.0	34.0
H6	11.0	29.0	37.0
H7	27.0	25.0	34.0
H8	24.0	8.0	56.0
H9	23.0	1.0	68.0
H10	34.0	29.0	52.0
Mean (SD)	27.3 (11.0)	13.1 (11.2)	49.1 (17.3)
M1	50.0	15.0	30.0
M2	13.0	10.0	7.0
M3	12.0	10.0	47.0
M4	36.0	15.0	21.0
M5	44.0	4.0	39.0
M6	30.0	25.0	24.0
M7	19.0	19.0	50.0
M8	21.0	5.0	48.0
M9	8.0	13.0	30.0
M10	24.0	42.0	37.0
Mean (SD)	25.7 (17.0)	15.8 (11.1)	33.3 (13.6)

An error analysis showed that two types of contextually inappropriate substitution errors were frequently made by the HLS in their use of evidential morphemes (see Table 4). The first type was substitutions by direct evidentials in places of indirect evidentials. The HLS outnumbered the monolinguals in making this kind of error ($t(18) = -2.537$, $p = 0.021$). The second pattern was substitutions by present progressive in places where a direct evidential should have been used but these substitutions were rarely made in either group ($t(18) = -0.156$, $p = 0.87$).

Table 4. The number of substitution errors in verb inflections in narratives produced by Turkish monolingual and heritage speakers.

	Direct evidential in place of Indirect evidential	Present progressive in place of direct evidential
Heritage speakers	47 (90%)	5 (45%)
Monolinguals	5 (10%)	6 (54%)

Determining the predictors of incorrect uses of evidentiality through machine learning

The HLS's utterances containing at least one evidential form were extracted and split into a total number of 404 clauses. The uses of these evidential forms were quantified as 'incorrect' vs. 'correct' depending on the evaluation of independent scorers. These accuracy data were fed into the learning algorithm as an index variable to act as the target classes (correct vs. incorrect; i.e., no-substitution vs. substitutions).

The outputs from the J48 classification algorithm revealed that the most powerful determiner of whether or not a clause with an evidential form would be uttered correctly was the HLS's self-reported daily receptive exposure to Turkish. The clauses produced by the HLS who have more than 2.88 hours of receptive exposure to Turkish everyday bear a greater likelihood of being 'correct' than those clauses from the HLS who have less exposure to

Turkish. Furthermore, the greatest number of incorrect uses of evidential forms were found in clauses from the HLS who have less than 1 hour of daily exposure to Turkish. This is graphically represented in the decision tree in Figure 1.

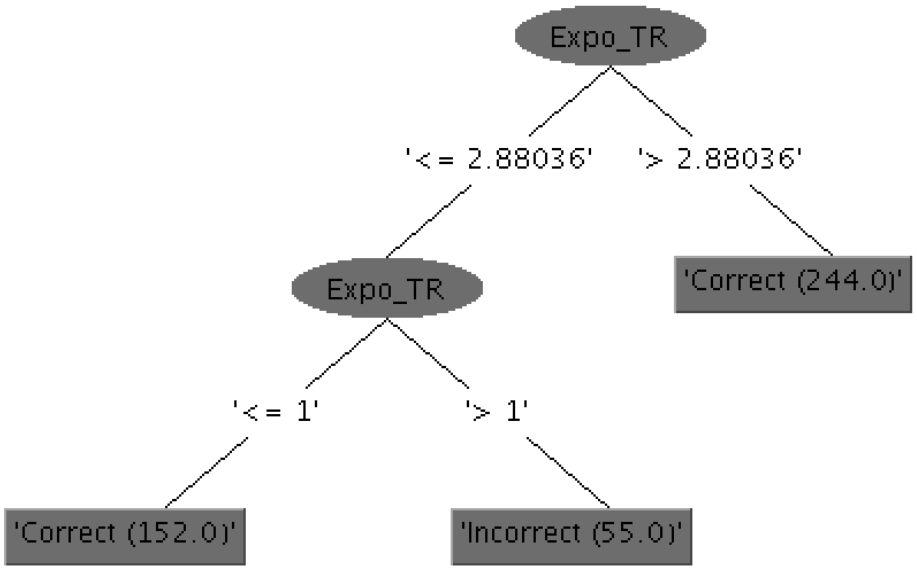

Figure 1. Graphical representation of the outcomes from the J48 tree-structure classification algorithm applied to the data. Expo_TR = daily number of hours being exposed to Turkish (e.g. reading, listening). The numbers on the branched lines indicate the cut-off points. The boxes indicate the number of precisely classified number of clauses with evidentiality. For instance, the algorithm precisely classified 55 incorrect clauses with evidentiality (i.e. the use of evidential was wrong in those clauses) from those who have less than or equal to 1 hour of exposure to Turkish.

Discussion

The current study aimed at exploring two research questions: (i) whether the production of direct and indirect evidential forms in Turkish HLS differs from a Turkish monolingual baseline, and (ii) if so, which input-related factors predict variability in HLS's non-target-like attainment of evidential forms in Turkish. Findings from our study have advanced our insights into Turkish HLS's non-target-like attainment of evidentiality and the potential causes for it.

With regard to our first research question, the HLS performed differently from monolingual speakers in producing evidential forms in their narratives. However, this was not immediately obvious at first sight. The HLS produced similar amounts of both evidential forms as compared to the monolingual baseline. This was true for the production of finite verbs overall despite a reduced diversity of finite verbs. A closer look revealed that the HLS tended to make a larger number of contextually inappropriate substitutions by using direct evidential forms in places where an indirect evidential should normally be used. This finding is fully reconcilable with the previous studies (Aarssen, 2001; Karakoç, 2007; Karayayla, To appear; Pfaff, 1993) which showed that both child and adult Turkish HLS are prone to indeterminacy in their choices of evidential forms. However, does this mean that our HLS never properly acquired the evidential distinctions? If the HLS never acquired these distinctions (i.e. incomplete acquisition), then they would not have been able to use the evidential forms to the same extent as the monolinguals did. Recall that we did not find a quantitative difference in the HLS's frequency of use of the evidential forms from the monolinguals. Therefore, we believe that evidentiality marking has possibly undergone a form of attrition (Polinsky, 2008, 2011). Please note that however at the absence of data from child HLS to disentangle between incomplete acquisition and attrition, we may only speculate over this possibility. Alternatively, evidentiality distinctions may have been simplified in Turkish heritage grammar through cross-generation attrition. This line of reasoning would be in line

with Pascual y Cabo and Rothman (2012) who suggest that heritage language acquisition occurs under different circumstances from monolingual language acquisition, and that input in heritage language conditions may be affected by attrition.

With regard to our second question, where we aimed to determine the input-related predictors of non-standard uses of evidential forms in the Turkish HLS. For this purpose, we used the J48 decision-tree based machine learning model, outputs from which have precisely indicated that the Turkish HLS's contextually inappropriate substitutions are largely predicted by the amount of (self-reported) exposure to Turkish. That is, the HLS who reported to be less exposed to Turkish in their daily life, produced greater amounts of contextually inappropriate choices of evidential forms, in comparison to the HLS who reported to be exposed relatively more to Turkish. The model's significant branching point in the decision tree was shown to be 2.88 hours of exposure daily (See Figure 1). This is a revealing finding in that non-standard uses of evidentiality marking in Turkish heritage grammar seems to be strongly linked to daily first (heritage) language exposure. We, therefore, support the theory that that predicts diminishing frequency of input to heritage language can lead to low sensitivity to heritage language features (Putnam & Sánchez, 2013). One needs to be cautious here however, as our data can only allow us to contemplate on input-related factors at the early adulthood phase of HLS. That is, the self-reported daily exposure data reported here represent the HLS's current exposure to Turkish; this exposure pattern may not be the same throughout their language development. Nonetheless, it still an interesting finding as variability in exposure to heritage language at early adulthood can significantly predict non-standard uses of their heritage language, complementing the burgeoning studies that reported importance of input frequency and quality during in both young and adult bilinguals (Montrul & Sánchez-Walker, 2013; Pascual y Cabo & Rothman, 2012; Putnam & Sánchez, 2013; Schmid, 2007).

The Turkish HLS's indeterminant uses of evidential forms in their first (heritage) language are largely compatible with the previous experimental psycholinguistic studies that measured Turkish HLS's online processing of evidentiality (Arslan et al., 2015; Arslan et al., 2017). Particularly, Arslan et al.'s (2015) visual world eye-movement monitoring study showed that adult Turkish HLS had less accurate responses and reduced proportions of looks to the target pictures than monolingual Turkish speakers in their evidentiality processing. These HLS were more accurate and had more settled fixations towards the target pictures in the indirect evidential condition than in the direct evidential condition. The authors argued that semantic and pragmatic functions of direct evidentiality in Turkish heritage grammar may have been simplified, and hence, Turkish HLS 'take the direct evidential to be a past tense marker without any specific evidential content' (Arslan et al., 2015, p. 11). In the current study, we found that our Turkish HLS over-extended uses of direct evidential forms in places where indirect evidentials normally would be more appropriate. This provides converging support to the claim that pragmatic and semantic distinctions of evidentiality marking in Turkish heritage grammar might, in fact, have been simplified, either possibly due to attrition in the individual or through being exposed to simplified and attrited input, or perhaps both (see Pascual y Cabo & Rothman, 2012; Schmid, 2007). As a consequence, the HLS use evidential forms indeterminately in their narrative speech, and they are less sensitive to information source contexts evidentials mark. There is experimental evidence for this insensitivity, see Arslan et al. (2017), who found that Turkish HLS in the Netherlands performed below chance in noticing information source – evidentiality mismatches in sentences.

One would, however, wonder to what extent these inflated uses of indirect evidentials found in the HLS are actually errors. We believe that these contextually inappropriate substitutions should not be taken as an absolute indicator of errors that lead to unsuccessful

communication. When a direct evidential replaces indirect evidential, sentence meaning does not become completely ungrammatical in Turkish, yet it becomes compromised in the semantic and pragmatic functions that can be fulfilled. Recall that the monolingual speakers also produced such substitution errors, though not to the same extent as the HLS. Importantly, switches between inflection forms in Turkish narratives are often done on purpose to fulfil certain pragmatic functions, such as, to indicate temporally asynchronous events (Aksu-Koç, 1994). This is not what we mean by a substitution error, we mean that a sentence clearly signals the speaker's indirect information regarding an event, and in such a context an indirect evidential would normally be appropriate, yet a direct evidential was used without a clear pragmatic or communicative motivation. In (3) below, we provide an illustration of such a contextually inappropriate substitution.

(3) An example from a HLS speech (H10)

Ananesinin	evine	gitmiş	*anenesi*	kapıyı
Grand mother.POSS	house.DAT	go.INDIRECTEVID.3ST	Grand mother.POSS	door.ACC
açmadı.	Camdan	içeri	bakmış.	
open.NEG.DIRECTEVID	window.ABL	inside	look.INDIRECTEVID.3ST	

'(she) went to her grandmother's house [indirect evidential], her grandmother did not open the door [direct evidential] (and then she) looked inside from the window [indirect evidential].'

In (3), *açmadı* 'did not open' (marked for direct evidential), for instance, was counted as a contextually inappropriate substitution. Controversially, the speaker shifts from the non-firsthand information perspective to firsthand perspective by using a direct evidential during retelling a folk tale. Such contextually inappropriate substitutions were found only minimally

in the narratives collected from the monolingual Turkish speakers. Evidential forms used in place of another form have been argued to expose counter-intuitive effects (Aikhenvald, 2004), and the less sensitivity to such effects in our HLS narratives clearly indicate that the evidentiality marking has been simplified in Turkish heritage grammars.

Another possibility is that the HLS are less comfortable in following, or even perhaps, are less aware of, the narrative conventions in Turkish. Therefore, they do not mind breaching those conventions and produce non-standard uses of evidentials in their narratives. While this idea may be partially accounted for by our data, it is not enough to explain the uni-directionality of substitutions. In other words, if the HLS's non-standard uses of evidentiality are caused by breaching the narrative conventions, we expect substitution errors of indirect evidential used in places of direct evidential as well. However, this was not what we found.

This small-sized study obviously had limitations. First, we would like to mention that the data we presented here showcased how important input-related factors would be at the early adulthood stage of Turkish HLS's language development. However, this cannot be extended to argue for or against incomplete acquisition and attrition accounts at the absence of developmental data from our HLS. Furthermore, beyond the fact that it is not warranted at what age grammatical knowledge becomes complete, it is also currently not examined at which age attainment of evidentiality fully stabilizes in Turkish children/adolescents. See, for instance, Özturk and Papafragou (2016) who reported that semantic and pragmatic notions of evidentiality are not fully acquired until the age of 6 or 7 in Turkish children, and their development probably extends beyond this age. Therefore, due to this gap in knowledge on the development of evidentiality in older children and adolescents, we are limited in our contemplation for whether or not evidentiality distinctions are incompletely acquired in Turkish HLS. Second, it is debated to what extent self-reported data are reliable in bilingualism research. We analyzed self-reported input-related factors in this study (e.g. daily

amount of exposure) in our participants' own estimates. Importantly, this study showed that self-reported daily exposure is an important predictor in language outcomes in heritage bilingualism. However, we still caution the reader that exposure data here are only estimated numbers by our participants. It is also not very clear how input features, such as input quality and length and quality of exposure, can actually be precisely measured. Authors in heritage bilingualism field mostly resort to using participant background questionnaires or surveys to collect data about input factors. Finally, note that we used Turkish spoken in Turkey as the reference baseline to test Turkish HLS's attainment of evidential forms. Although using monolingual baselines is a standard way of comparison in most previous studies, it is obvious here that the HLS are less sensitive to aspects of narrative production compared to monolingual individuals. This results in an unavoidable monolingual advantage. To make things rather fair for our heritage speakers, we may have alternatively looked at the production of evidential forms in their societally dominant language narratives (i.e. Dutch). However, evidentiality marking in Dutch is not grammaticalized as it is in Turkish. It is worthwhile, however, to conduct a future study to see whether or not Turkish heritage speakers use comparable evidential strategies in their societally dominant languages. Cross-linguistic convergence of evidentiality is indeed not uncommon, see for instance Sánchez (2004) who showed emerging evidential forms in Spanish (a non-evidential language) spoken by Quechua speakers.

Conclusions

In this chapter, we presented a preliminary study reporting on the use of evidential verb forms in adult Turkish HLS's narratives. We used this preliminary data to implement a machine learning algorithm to determine which input-related factors predict the HLS's contextually inappropriate uses of evidentiality. Based on the findings from this preliminary work, an

overall conclusion we can arrive at is that HLS's daily exposure to Turkish is the most important determiner of their contextually inappropriate uses of evidential forms. We should note however; Turkish HLS's bilingualism background data contain large variability even in a sample of 10 individuals. Finally, this study showcased that J48 algorithm, a machine learning algorithm for decision-tree based classification, is useful in analyzing more than one input-related factors as determinants of HLS language outcomes.

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